X-RAY, EUV, UV AND OPTICAL EMISSIVITIES OF ASTROPHYSICAL PLASMAS

This grant includes work on computer codes to predict X-ray and EUV emission spectra, improvement of the accuracy of the atomic rate coefficients which enter those codes, and application to stellar coronae, binary X-ray sources, and hot interstellar gas in the Galaxy in general and in supernova remnants.

I. Improved X-ray Emission Code.

In this reporting period we have concentrated on evaluating the available collision strength and dielectronic recombination data and on incorporating the iron L-shell collision strengths of Duane Liedahl (computed with HULLAC) in the code. We have published the first major results, an evaluation of the M-shell collisional data for iron based on SERTS and EUVE data (Brickhouse, Raymond and Smith 1995). We have critically compared the existing X-ray emission codes as a follow-on to the Napa HEAD meeting in 1994 (Brickhouse et al. 1995). We are using ASCA spectra and EUVE spectra to further test the reliability of the codes by testing whether a single set of model parameters can account for the entire observed spectrum. We have written a review of the emission spectra of hot astrophysical plasmas emphasizing some lesser-known processes (Raymond and Brickhouse 1996). We have also considered the effects of non-Maxwellian electron velocity distributions on emission line spectra (Anderson, Raymond and van Ballegooijen 1996). N. Brickhouse presented a colloquium on the use of spectral models for EUV Astrophysics at Auburn U in February 1995. All three of us participated actively in the Rates, Codes, & Astrophysics Workshop in July 1995, sponsored by the AXAF Science Center, serving on the organizing committee (Raymond, Brickhouse), chairing a session on atomic rate uncertainties (Raymond), and presenting papers on photoionized plasmas (Liedahl) and spectral fitting approaches (Brickhouse).

II. Supernova Remnants

We participated in an analysis of ROSAT observations of a cloud in the Cygnus Loop (Graham et al 1995), and we are engaged in a program to combine ROSAT, IUE, HUT and optical observations of a shocked cloud in the Cygnus Loop, including the only useful [Ne V] images of a supernova remnant of which we are aware. J. Raymond presented a review of supernova remnant shock waves at the APS meeting in Washington, DC in April 1995.

III. Binary X-ray Sources.

Papers on ORFEUS observations of AM Her (Raymond et al 1995) and an archival study of HST observations of HZ Her (Cheng, Vrtilek and Raymond 1995) were published, and a paper on the cataclysmic variable TV Col is in press. D. Liedahl presented a seminar at CfA on the identification and interpretation of recombination edges in the ASCA spectrum of Cyg X-3.

IV. Stellar Coronae

A paper on the use of the coronal forbidden lines as temperature diagnostics for the corona was published (Esser et al. 1995), incorporating the updated atomic data as well as models for photoexcitation from the disk radiation. N. Brickhouse presented a review at the IAU Colloquium on "Astrophysics in the Extreme Ultraviolet" in March 1995. She presented a paper at the Cool Stars Workshop in October 1995 on the EUV transition region lines of Capella. She also presented a review of EUV results on stellar coronae at the "APS Topical Conference on Atomic Processes in Astrophysics" in January 1996.

References

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Using Fe X 6374 Å and Fe XIV 5303 Å Spectral Line Intensities to Study the Effect of the Line of Sight on Coronal Temperature Inferences, R. Esser, N.S. Brickhouse, S.R. Habbal, R.C. Altrock and H.S. Hudson, 1995, *J. Geophys. Res.*, **100**, 19839

Conference Presentations and Papers

Dissecting the EUV Spectrum of *Capella*, N.S. Brickhouse, 1996, Invited Review to appear in *Astrophysics in the Extreme Ultraviolet*, IAU Coll. No. 152

High Temperature Structure in Cool Binary Stars, A.K. Dupree, N.S. Brickhouse, and G.J. Hanson, 1996, to appear in *Astrophysics in the Extreme Ultraviolet*, IAU Coll. No. 152

Coronal Structure in Capella, A.K. Dupree and N.S. Brickhouse, 1996, to appear in *Stellar Surface Structure*, IAU Symp. No. 176

The EUV Transition Region of Capella, N.S. Brickhouse, A.K. Dupree, and J.C. Raymond, 1996, to appear in *Proceedings of Cool Stars Workshop, 9*